

Effect of Aerobic Interval Training on Blood Pressure and Myocardial function in Hypertensive Patients.

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ABSTRACT: Background And Objective-Hypertension is an important risk factor for cardiovascular disease (CVD), affecting about 1 billion people worldwide,. Physical activity is recommended as prevention, treatment and control of all stages of hypertension. There are still controversies about the optimal training dose, frequency, and intensity. Several study shown that aerobic interval training (AIT) improves aerobic fitness. We aimed to study the effect of aerobic interval training on blood pressure & myocardial function in hypertensive patients.

Intervention-Aerobic interval training- Total exercise time is 35 min 3 times per week for 12 weeks.

Outcome measures- Blood pressure, heart rate & Echocardiography

Methods And Results-Study design:- experimental (pre-post) study, study population:- patients with hypertension, Sample size: 30 patients (12 women).data were analyzed on after 12 weeks of aerobic interval training with students paired t-test. AIT reduced systolic BP by 12mmhg and diastolic BP was reduced by 8mmhg.the AIT achieved a reduction in HRmean with 4 b/min. In echocardiograph findings were improved the ejection fraction, stroke volume, cardiac output, end-diastolic volume and total peripheral resistance decreased by 17% This is a study mainly showing the physiological effects of training in hypertension.

Conclusion- this study indicates that aerobic interval training is effective to reduce blood pressure & heart rate and improve myocardial function in hypertensive patients.

KEYWORDS: Aerobic Interval Exercise, Blood Pressure, Hypertension, HR_{MAX}, Echocardiography.

I. INTRODUCTION

Hypertension is an important risk factor for cardiovascular disease (CVD), affecting about 1 billion people worldwide, Low aerobic fitness is a strong predictor for future CVD and is the top global risk factor for mortality.[1] Hypertension (systolic and diastolic blood pressure >140/90 mmHg) is a major modifiable risk factor for cardiovascular disease. Elevated blood pressure levels have been shown to be a risk factor for stroke, congestive heart failure, myocardial infarction, peripheral vascular disease, and end-stage renal disease[2] Primary (or essential) hypertension is when the cause is unknown. The majority of hypertension cases are primary. When there is an underlying problem such as kidney disease or hormonal disorders that can cause hypertension, it is called secondary hypertension. When it is possible to correct the underlying cause, high blood pressure usually improves and may even return to normal. Other factors that can contribute to hypertension include: age (blood pressure usually increases with age), diet , excessive alcohol consumption, lack of exercise, obesity, sleep apnea, stress [3]

Low aerobic fitness is a strong predictor for future CVD and all-cause mortality in patients, including those with hypertension. [4] The recent Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, recommended that optimal blood pressure levels should be less than 120/80 mmHg, for resting systolic and diastolic blood pressure respectively. Non-pharmacological intervention in the form of regular aerobic exercise has been recommended for the prevention of high blood pressure as well as the lowering of blood pressure among those individuals, with elevated level. Physical inactivity is associated with increased risk of development of both hypertension and coronary artery disease (CAD). [5,6,7] Physical activity is recommended as prevention, treatment and control of all stages of hypertension. Regular exercise is a well-established intervention for the prevention and treatment of several chronic diseases, including hypertension [8] Higher levels of physical activity and cardiorespiratory fitness have shown to reduce the risk of hypertension in healthy normotensive persons. [9,10] Moreover, exercise can reduce BP in hypertensive adults [11] , and has shown to improve several factors involved in the pathophysiology of hypertension [12,14] Continuous exercise training is the type of physical activity most frequently recommended to hypertensive subjects. However, some

studies have shown that interval exercise training may have greater effects on exercise capacity in healthy subjects and those with cardiovascular disorders. Interval training promotes greater gradients of shear stress because patients fluctuate between high and low intensities[14,15,16]

Aerobic Interval training is a type of discontinuous physical training that involves a series of low- to high-intensity exercise workouts interspersed with rest or relief periods. . This does not allow for full recovery and thus maintains stress on the aerobic system. the high-intensity periods are typically at or close to anaerobic exercise, while the recovery periods may involve either complete rest or activity of lower intensity. Interval training is a favorite of coaches because of its effectiveness in cardiovascular build-up.[17] AIT, which some experts also call fitness interval training, focuses on working harder during your intervals, but not going all out, as you do with anaerobic training. AIT involves alternating moderate to high intensity exercise (e.g., running briskly) with a recovery period (e.g., walking).[18] The idea is to work harder during work intervals while keeping the intensity below 85 percent of your maximum heart rate. Interval training is built upon alternating short, high intensity bursts of speed with slower, recovery phases throughout a single workout.[18,19] Interval training works both the aerobic and the anaerobic system. During the high intensity efforts, the anaerobic system uses the energy stored in the muscles (glycogen) for short bursts of activity. Interval training adheres to the principle of adaptation. Interval training leads to many physiological changes including an increase in cardiovascular efficiency (the ability to deliver oxygen to the working muscles) as well as increased tolerance to the build-up of lactic acid. These changes result in improved performance, greater speed, and endurance.[20]

The aim of this study was to determine the Effect Of Aerobic Interval Training On Blood Pressure And Myocardial Function In Hypertensive Patients.

II. SUBJECTS AND METHODS

We studied 30 subjects (18 male, 12 female) with essential hypertension. Study Design was experimental

Pre -post study. Study was conducted at Dept. of cardiorespiratory physiotherapy, Pravara rural hospital, Loni, India. Inclusion Criteria were; Both male and female, Age < 65 Years, & Essential Hypertension- Stage 1-2,

As Systolic BP 140-179mmhg & Diastolic BP 90-109. We excluded subjects with diagnosed Patient with secondary hypertension, left ventricular hypertrophy, Recent myocardial infarction., Three or more risk factors of CVD, Patients using more than one antihypertensive drug. Measurement done at the end of this period were used as baseline. all the measurements used in the analysis were done before and after the training period. The study protocol was approved by the regional committee for medical ethical research of the PIMS university and All patients provided informed consent before participation. All subjects performed the Aerobic Interval Training, consisting of 10 minutes warm up at 50% of HR max, 3x4 minute intervals at 80 to 85 % of HR max walking / running on a treadmill, with 4 min of active pause between the exercise bouts at 60 to 70% HRmax. Exercise intensity was calculated with the Karvonen's formula. The Session was terminated with 5 minutes cool down. Total exercise time is 35 minutes. Exercise was given at laboratory 3 times per week for 12 weeks.

III. OUTCOME MEASURES

Blood Pressure & Heart Rate-

Blood pressure was measured by sphygmomanometer and heart rate was monitored with pulse Oxymeter. The values used for statistical analyses are average systolic and diastolic blood pressure and mean heart rate .

Echocardiography-

All subjects had an echocardiogram and were examined at rest by an experienced cardiologist. Using vivid 7 scanner with M3S probe. B mode images were recorded with a frame rate of 54 frames per second. Left ventricular volume (LV) and ejection fraction (EF) were calculated from apical four and two chamber recordings by modified biplane Sampson's method. The stroke volume was measured by Doppler flow measurement in the left ventricular outflow tract and LVOT diameter. Cardiac output was calculated automatically by the echocardiographic scanner and multiplies stroke volume and HR during the echocardiographic examination.

Total Peripheral Resistance-

It was calculated by mean arterial pressure divided by cardiac output and multiplied by 80.

IV. DATA ANALYSIS & RESULTS

Data were analyzed on after 12 weeks of aerobic interval training and presented as mean (SD) were analysed with students paired T-test.

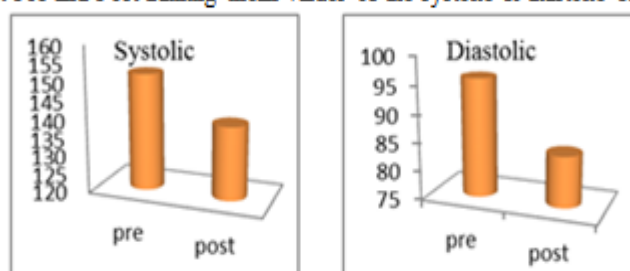
Table 1: Baseline characteristics

Characteristics	AIT
MALE/ female	18/12
Age(years)	52±7
BMI(kg/m ²)	25.8±4
Systolic BP(mmhg)	152±12
Diastolic BP(mmhg)	96±8
HR(beats/min)	74±8

Table 2: Pre and Post training mean values of the systolic & diastolic blood pressure and heart rate

Measurement	Pre-training	Post-training
Systolic BP(mmhg)	152±12	140±12.5
Diastolic BP(mmhg)	96±8	84±8
Heart Rate (beats/min)	74±8	70±7.5

Fig. No.1 :: Pre and Post training mean values of the systolic & diastolic blood pressure



All the values are statistically highly significant.

In Blood Pressure And Heart Rate

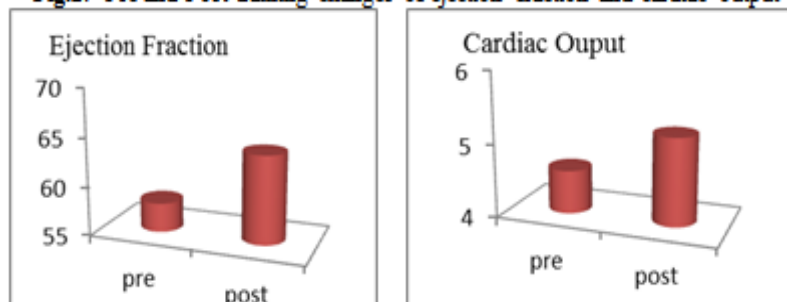
The results of blood pressure and heart rate are illustrated in table no.2 and numbered in figure no.2. The AIT reduced systolic BP by 12mmhg ($p<0.001$) and Diastolic BP was reduced by 8mmhg. The AIT achieved a reduction in HR mean with 4 b/min ($p<0.01$)

Table 3: Pre and Post training echocardiographic measurements

Measurement	PRE	POST
EF %	58	64
EDV ml	110	122
SV ml	72	80
CO l/min	4.6	5.2
HR at rest b/min	65	67
TPR	2050	1660

EF, ejection fraction; EDV, end diastolic volume; SV, stroke volume; CO, cardiac output; HR, heart rate; TPR, total peripheral resistance.

Fig.2: Pre and Post training changes of ejection fraction and cardiac output



All the values are statistically highly significant.

Echocardiograph findings-

Results of echocardiographic findings illustrated in table no.3 & in figure no.2. AIT improved the ejection fraction, stroke volume, cardiac output, end-diastolic volume(12%, p= 0.01) Total Peripheral Resistance decreased by 17% (p=0.03) after aerobic interval training.

V. DISCUSSION

This study evaluates the effect of aerobic interval training on blood pressure and myocardial function in hypertensive patients. And showing significant reduction in blood pressure, improvement in cardiac function, aerobic capacity and reduction of mean heart rate.

Blood pressure and heart rate

Several studies have found the anti-hypertensive effect of endurance training to be in the region of 3-10.5 for systolic and 2-7.6 mmHg for diastolic blood pressure respectively.[13,21] Another meta-analysis, which included ambulatory blood pressure measurements, demonstrated that aerobic exercise decreases systolic/diastolic blood pressure by 4.5/2.4mmHg during the daytime and 1.7/0.7mmHg during the nighttime. Our study is agreement with these results; blood pressure in our subjects decreased during the daytime, mainly in those with higher blood pressure values.[13,16,21] The mechanism of blood pressure lowering effect of exercise are complex and not fully understood. HR recovery after exercise test has showed to be mediated by the vagal reactivation following the termination of the sympathetically activated state of exercise the observation of our study of reduced HR after exercise is in accordance with the other studies suggesting an increased vagal tone and reduced sympathetic drive[22] In this small study changes were highly significant after aerobic interval training.

Echocardiographic findings

AIT improved both the systolic and diastolic function significantly. The positive effect of high intensity exercise on myocardial function in other CVD has been well documented in previous studies.[23] our study demonstrated an increase in stroke volume, end diastolic volume and ejection fraction significantly. Diastolic dysfunction is a common finding in hypertension, but our population was within the normal range when indexed for age[24].

VI. LIMITATIONS

The study relatively small and comes only from an intervention of 12 weeks. this is mainly a study of the physiological effect of training in hypertension.

In this study we did not measure the physical activity outside the body, and we did not make any dietary registration. The number of patients in this study are too small to estimate the issue of safety.

VII. CONCLUSION

In this study series of moderate to high intensity on the form of 3-weekly bouts of interval training for 12 weeks reduced systolic and diastolic blood pressure and improved cardiac function. From this study it was concluded that Aerobic interval training is effective to reduce blood pressure & heart rate and improves myocardial function in hypertensive patients.

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